Bellwork: 5/9/13

Identify each function as either growth or decay.

1) $y = 9(.75)^x$ decay

2) $y = .34(5/4)^x$ growth

3) $y = -5(7/8)^x$ decay

Application:

Bacteria are very small single-celled organisms that live almost everywhere on Earth. Most bacteria are not harmful to humans, and some are helpful, such as the bacteria in yogurt.

Bacteria reproduce, or grow in number, by dividing. The total number of bacteria at a given time is referred to as the population of bacteria. When each bacteria in a population of bacteria divides, the population doubles.

Time (hr)	0	1	2	3	4	5	6
Population	25	50	100	200	400	800	1600

1) Write an algebraic expression that represents the population of bacteria after n hours. (Hint : Factor out 25 from each population figure.)

$y = 25(2)^x$

2) Use your algebraic expression to find the population of bacteria after 10 hours and after 20 hours.

10 hrs: $25(2)^{10} = 25,600$ bacteria

20 hrs: $25(2)^{20}$

26,214,400 bacteria

3) Suppose that the initial population of bacteria was 75 instead of 25. Find the population after 10 hours and after 20 hours.

$y = 75(2)^x$

10 hrs: $75(2)^{10} = 76{,}800$ bacteria

20 hrs: $75(2)^{20} = 78{,}643{,}800$ bacteria

- The population after x hours can be represented by an exponential equation
  - Because the exponent is positive and the base is a fixed number, also called the multiplier.

exponent will always be a unit of time

$$y = \text{initial value}(\text{multiplier})^x$$

Modeling Growth: multiplier: growth → add percent to 100 & convert to decimal; decay → subtract % from 100 → decimal

Example 1: The population of the United States was 248,718,301 (initial value) in 1990 and was projected to grow at a rate of about 8% per decade. 108% 1.08

Predict the population, to the nearest hundred thousand, for the years 2010 and 2025.

1) Obtain a multiplier. 1.08

2) Write an expression for the population in n decades after 1990.

$y = 248{,}718{,}301(1.08)^x$

3) a) for 2010 2 decades

$248{,}718{,}301(1.08)^2$

290,105,026 people

b) for 2025 3.5 decades

$248{,}718{,}301(1.08)^{3.5}$

325,604,866 people

Example 2: You invest $1000 in a savings account at the end of 5^{th} grade. The account pays 5% annual interest. How much money will be in the account when you graduate from high school?

every year

growth → 100 + 5 = 105%

$y = 1000(1.05)^7 = \$1407.10$

Try This: The population of Delaware was about 262,650 in 2006 and was projected to grow at a rate of about 7.7% per decade. Predict the population, to the nearest hundred thousand, of Delaware for 2016 and 2020.

Modeling Decay: Decay = 100 − percent convert to decimal.

Example 3: The rate at which caffeine is eliminated (decay) from the bloodstream of an adult is about 15% per hour. An adult drinks a caffeinated soda, and the caffeine in his or her bloodstream reaches a peak level of 30 milligrams. (initial value)

Predict the amount, to the nearest tenth of a milligram, of caffeine remaining 1 hour after the peak level and 4 hours after the peak level.

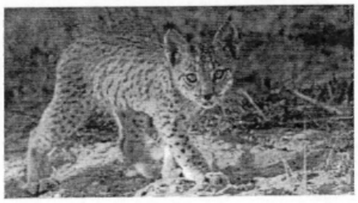
$100 - 15 = 85\%$
$= .85$

$y = 30(0.85)^x$

1 hr:
$y = 30(.85)^1$
25.5 mg

4 hrs:
$y = 30(.85)^4$
15.7 mg

Example 4: The population of the Iberian lynx for 2003 was 150 and in 2004 it was 120. If this trend continues and the population is decreasing exponentially, how many Iberian lynx will there be in 2014?



Try This: A vitamin is eliminated (decay) from the bloodstream at a rate of about 20% per hour. The vitamin reaches a peak level in the bloodstream of about 300 milligrams. Predict the amount, to the nearest tenth of a milligram, of the vitamin remaining 2 hours after the peak level and 7 hours after the peak level.

100 − 20
80%
0.80

$y = 300(.80)^x$

2 hrs:
$300(.80)^2$
192.0 mg

7 hrs
$300(.80)^7$
62.9 mg

Homework: pg 14 all

Keystone Assignment:
Unit 6 → pgs 143 − 157